WE CLAIM:

1. A structure for metallurgical connections between metal wires and bond pads positioned on integrated circuits having copper interconnecting metallization, comprising:

a bond pad surface of non-oxidized copper;

a layer of barrier metal that resists copper diffusion deposited on said copper surface, said barrier metal and the thickness thereof coordinated such that said layer reduces the diffusion of copper at 250 °C by more than 80 % compared with the absence of said barrier metal;

an outermost layer of bondable metal, coordinated with the thickness thereof such that said outermost layer reduces the diffusion of said barrier metal at 250 °C by more than 80 % compared with the absence of said bondable metal; and

one of said metal wires bonded to said outermost bondable metal.

2. The structure according to Claim 1 wherein said barrier metal layer is selected from a group consisting of nickel, cobalt, chromium, molybdenum, titanium, tungsten, and alloys thereof.

3. The structure according to Claim 1 wherein said bondable metal layer is selected from a group consisting of gold, platinum, palladium, and silver.

4. The structure according to Claim 1 further comprising a thin seed metal layer between said non-oxidized copper and said barrier metal layer.

5. The structure according to Claim 4 wherein said seed

metal is palladium or tin.

6. The structure according to Claim 1 wherein said metal wires are selected from a group consisting of gold, copper, aluminum, and alloys thereof.

7. A method for forming metallurgical connections between metal wires and bond pads positioned on integrated circuits having copper interconnecting metallization, comprising:

activating the surface of said copper metallization of said bond pads, depositing seed metal;

plating a layer of barrier metal that resists copper diffusion, by electroless deposition, said barrier metal and the thickness thereof coordinated such that said layer reduces the diffusion of copper at 250 °C by more than 80 % compared with the absence of said barrier metal;

plating a layer of a bondable metal, by electroless deposition, said bondable metal and the thickness thereof coordinated such that said layer reduces the diffusion of said barrier metal at 250 °C by more than 80 % compared with the absence of said bondable metal, thereby forming the outermost bondable metal layer of said bond pad; and

bonding one of said metal wires onto said outermost metal.

8. The method according to Claim 7 wherein said wire bonding step comprises ball bonding or wedge bonding.

9. The method according to Claim 7 wherein said bond pads are formed by a process comprising:

depositing a protective overcoat over the surface of said integrated circuit, including the surface portions having copper metallization; and

opening selected areas of said overcoat by photolithographic techniques, exposing the surface of said copper metallization.

10. The method according to Claim 9 further comprising a cleaning step after said opening step, by immersing said exposed copper surface in a solution of sulfuric acid, nitric acid, or any other acid.

11. The method according to Claim 7 wherein said step of activating comprises immersing the bond pads in a catalytic metal chloride solution.

12. The method according to Claim 11 wherein said metal chloride is palladium chloride, depositing palladium seeds.

13. The method according to Claim 7 wherein said electroless plating of said bondable metal layer is immersion plating.

14. The method according to Claim 7 wherein said electroless plating of said bondable metal layer is immersion plating followed by autocatalytic plating.

15. The method according to Claim 7 further comprising the step of electrically probing said outermost metal of said bond pad before the step of bonding, leaving substantially no probe marks.